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## NORMAL GROWTH OF RANGE CATTLE

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### CONTENTS

|                                              | Page |                           | Page |
|----------------------------------------------|------|---------------------------|------|
| Location of range.....                       | 1    | Average yearly gains..... | 7    |
| Origin and management of the cattle.....     | 1    | Variations in gains.....  | 9    |
| Individual cattle weights, 1916 to 1924..... | 3    | Summary.....              | 11   |

### LOCATION OF RANGE

In connection with the investigation of stock-poisoning plants carried on by the Bureau of Animal Industry, United States Department of Agriculture, at the Salina experiment station, near Salina, Utah, since 1915, considerable information regarding the normal gains in weight made by cattle on the summer range has been obtained. There is little previous definite information regarding the growth of animals under these conditions.

The Salina experiment station is situated on the Fishlake National Forest, in the Wasatch Mountains of Utah, at an altitude of approximately 8,000 feet. It is in a cattle and sheep range country, which is fairly typical of this part of Utah. In fact, the pastures are a portion of the cattle range fenced off for the station's use. The sheep and horse range joins it along one side. Aspen groves, oak ridges, and small meadows make up most of the area under fence.

The particular pasture which has been used for cattle has furnished ample forage for the number of animals kept in it, as is shown by the fact that the vegetation has improved from year to year since the station was established. Forage, too, is fully as varied as on the surrounding range. Water is ample at all times and of good quality.

### ORIGIN AND MANAGEMENT OF THE CATTLE

Each year cattle have been obtained from local stockmen and placed in the pasture as early in the season as conditions would permit. In 1915 several different persons furnished animals, each lending a few head. Since then practically all the cattle have been

furnished by one man, G. A. Christensen, of Redmond, Utah. All animals have been of native stock, raised in the general neighborhood of Salina. Their ages have varied from calves to 3 years or more, though most of them have been yearlings and 2-year-olds.

In this general portion of Utah cattle are run on the higher ranges during summer months, and in the winter are kept in the valleys, most of them being held in pastures and fed during periods of bad weather. During the winter months no attempt is made to fatten animals which are to go on the range again the following summer. Naturally these cattle are not always in the best condition in the spring, though very few of them are particularly poor.

Though cattle are kept at the Salina experiment station primarily for use in the experimental work with stock-poisoning plants, each year there have been a number not used in the experimental feedings.

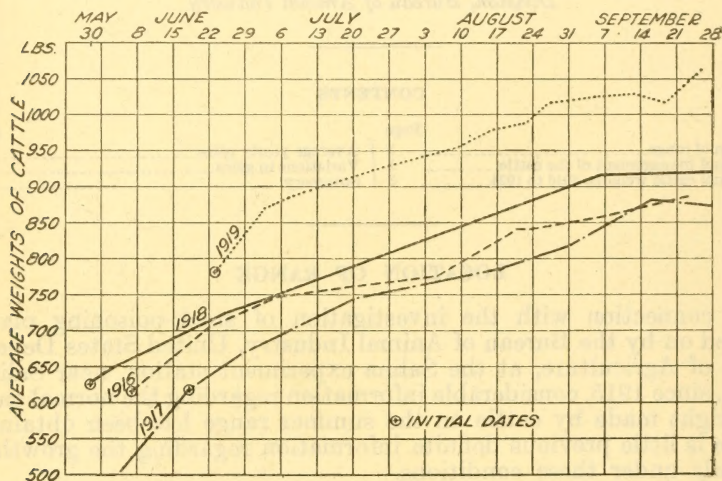


FIG. 1.—Average gains in weight made by cattle kept in pasture at Salina experiment station, Utah, during summers of 1916, 1917, 1918, and 1919

These animals were kept in one of the pastures and not disturbed except to bring them in to the corrals at intervals to weigh them. During the first years these weighings were not made at stated intervals; but, in 1919 and the following summers, attempts were made to weigh them on Saturday of each week. This has been accomplished with fair success. Inability to find certain animals at times and the fact that some have broken out of the pastures at intervals have interfered somewhat with the regularity of the weighings, but have in no way affected the general results.

In the average season, at the Salina experiment station, some snow remains until about the first of June; it is fully as late as that before the vegetation starts. The cattle are, therefore, obtained as soon as the pastures can furnish them with forage. By the end of September, vegetation has been killed by the frosts and has largely dried up. Governed by the season, the station at Salina is usually opened the first of June and closed the first of October.

## INDIVIDUAL CATTLE WEIGHTS, 1916 TO 1924

During the nine years for which weight records were kept (1916 to 1924, inclusive) 108 normal cattle were weighed at frequent intervals and were kept under conditions closely comparable to those on the

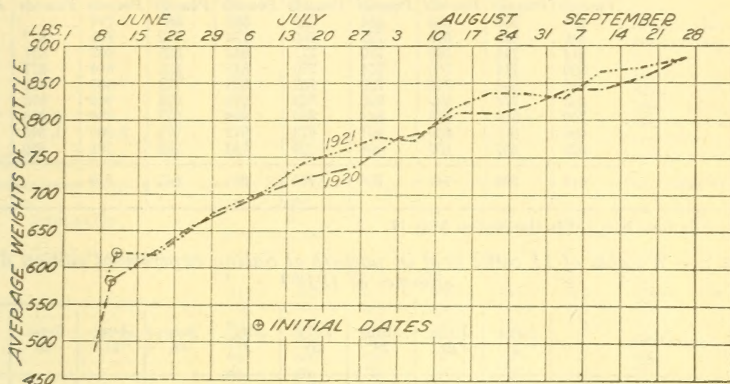


FIG. 2.—Average gains in weight made by cattle kept in pasture at Salina experiment station, Utah, during summers of 1920 and 1921

range. The number of these animals in different years varied between 3 in 1919 and 22 in 1923. In Tables 1 to 9 the weights of the animals at the different weighing periods are given, together with the averages

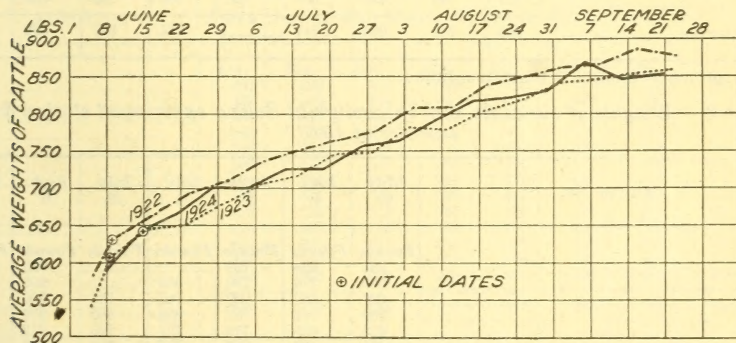


FIG. 3.—Average gains in weight made by cattle kept in pasture at Salina experiment station, Utah, during summers of 1922, 1923, and 1924

of all animals for each date on which they were weighed. The weights given in these tables furnish the facts on which the subsequent tables, figures, and statements are based. The general averages for each weighing period are shown graphically in Figures 1, 2, and 3.

TABLE 1.—Weights of nine cattle kept in pasture at Salina experiment station during summer of 1916 <sup>1</sup>

| Animal No.   | June 7        | June 22       | July 5        | July 18       | Aug. 5        | Aug. 21       | Aug. 24       | Sept. 7       | Sept. 12      | Sept. 23      |
|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|              | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> |
| 707-----     | 456           | 528           | 566           | 584           | 616           | 684           | 680           | 714           | -----         | 748           |
| 708-----     | 540           | 629           | 678           | 722           | 680           | 758           | 772           | 798           | 817           | 804           |
| 709-----     | 674           | 746           | 780           | 770           | 771           | 842           | 825           | 842           | 881           | 870           |
| 710-----     | 600           | 714           | 760           | 754           | 770           | 845           | 825           | 844           | 877           | 875           |
| 711-----     | 616           | 686           | 715           | 720           | 752           | 804           | 778           | 805           | 852           | 830           |
| 716-----     | 686           | 776           | 832           | 820           | 863           | 908           | 944           | 946           | 970           | 976           |
| 717-----     | 750           | 844           | 885           | 884           | 939           | 988           | 977           | 989           | 1,036         | 1,032         |
| 718-----     | 696           | 818           | 850           | 904           | 873           | 972           | 976           | 1,000         | 1,045         | 1,030         |
| 719-----     | 525           | 597           | 660           | 668           | 709           | 764           | 789           | 791           | 830           | 821           |
| Average----- | 616           | 704           | 747           | 758           | 775           | 841           | 841           | 859           | -----         | 887           |

<sup>1</sup> The cattle were brought to the station May 17.TABLE 2.—Weights of 11 cattle kept in pasture at Salina experiment station during summer of 1917 <sup>1</sup>

| Animal No.   | June 5        | June 19       | June 28       | July 20       | Aug. 1        | Aug. 18       | Aug. 31       | Sept. 16      | Sept. 28      |
|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|              | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> |
| 745-----     | 460           | 580           | 612           | 678           | 696           | 710           | 747           | 815           | 834           |
| 746-----     | 606           | 740           | 780           | 874           | 876           | 880           | 905           | 980           | 936           |
| 747-----     | 578           | 722           | 783           | 876           | 899           | 920           | 938           | 982           | 988           |
| 748-----     | 516           | 592           | 653           | 726           | 743           | 746           | 774           | 835           | 840           |
| 749-----     | 530           | 586           | 632           | 736           | 770           | 804           | 816           | 904           | 906           |
| 752-----     | 685           | 818           | 868           | 942           | -----         | 904           | 1,030         | 1,104         | 1,087         |
| 753-----     | 294           | 342           | 384           | 450           | -----         | 500           | 561           | 574           | 584           |
| 754-----     | 448           | 556           | 592           | 662           | 696           | 707           | 738           | 813           | 766           |
| 762-----     | 533           | 680           | 750           | 824           | 868           | 890           | 914           | 994           | 1,016         |
| 767-----     | 614           | 782           | 842           | 910           | 926           | 940           | 969           | 1,050         | 1,030         |
| 768-----     | 300           | 399           | 434           | 508           | 526           | 550           | 599           | 650           | 615           |
| Average----- | 506           | 618           | 666           | 744           | -----         | 786           | 817           | 882           | 873           |

<sup>1</sup> The cattle were brought to the station June 4.TABLE 3.—Weights of six cattle kept in pasture at Salina experiment station during summer of 1918 <sup>1</sup>

| Animal No.   | May 30        | June 4        | June 25       | July 11       | July 26       | Sept. 6       | Sept. 29      |
|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|              | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> | <i>Pounds</i> |
| 753-----     | 581           | 603           | 704           | -----         | -----         | 920           | 893           |
| 758-----     | 696           | 716           | 799           | 800           | -----         | 958           | 969           |
| 765-----     | 630           | 660           | 709           | 747           | 786           | 900           | 934           |
| 771-----     | 700           | 734           | 787           | 826           | 860           | 976           | 992           |
| 806-----     | 624           | 635           | 716           | 756           | 798           | 912           | 905           |
| 810-----     | 525           | 560           | 624           | 678           | 700           | 830           | 830           |
| Average----- | 626           | 651           | 723           | -----         | -----         | 916           | 920.5         |

<sup>1</sup> The cattle were brought to the station May 27.TABLE 4.—Weights of three cattle kept in pasture at Salina experiment station during summer of 1919 <sup>1</sup>

| Animal No.   | June 23     | July 3      | July 8      | July 25     | Aug. 4      | Aug. 9      | Aug. 16     | Aug. 23     | Aug. 27     | Sept. 6     | Sept. 13    | Sept. 19    | Sept. 26    |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|              | <i>Lbs.</i> | <i>Lbs.</i> | <i>Lbs.</i> | <i>Lbs.</i> | <i>Lbs.</i> | <i>Lbs.</i> | <i>Lbs.</i> | <i>Lbs.</i> | <i>Lbs.</i> | <i>Lbs.</i> | <i>Lbs.</i> | <i>Lbs.</i> | <i>Lbs.</i> |
| 833-----     | 792         | 923         | 944         | 986         | 992         | 1,002       | 1,044       | 1,060       | 1,082       | 1,076       | 1,080       | 1,089       | 1,120       |
| 846-----     | 793         | 870         | 890         | 922         | 950         | 954         | 968         | 990         | 1,008       | 1,026       | 1,010       | 1,003       | 1,054       |
| 847-----     | 757         | 818         | 825         | 863         | -----       | 896         | 918         | 918         | 956         | 974         | 998         | 966         | 1,017       |
| Average----- | 781         | 870         | 886         | 924         | -----       | 951         | 977         | 989         | 1,015       | 1,025       | 1,029       | 1,019       | 1,064       |

<sup>1</sup> The cattle were picked up on the range and delivered to the station June 22 and 23.

TABLE 5.—Weights of eight cattle kept in pasture at Salina experiment station during summer of 1920<sup>1</sup>

| Animal No. | June 7 | June 10 | June 14 | June 26 | July 2 | July 10 | July 17 | July 26 | Aug. 3 | Aug. 7 |
|------------|--------|---------|---------|---------|--------|---------|---------|---------|--------|--------|
|            | Lbs.   | Lbs.    | Lbs.    | Lbs.    | Lbs.   | Lbs.    | Lbs.    | Lbs.    | Lbs.   | Lbs.   |
| 858        | 566    | 670     | 703     | 771     | -----  | 834     | 837     | 868     | 944    | 934    |
| 860        | 497    | 582     | 614     | 665     | 648    | 714     | 744     | 740     | 802    | 795    |
| 862        | 469    | 564     | 580     | 625     | 632    | 672     | 686     | 682     | 694    | 744    |
| 864        | 420    | 510     | 530     | 576     | 572    | 620     | 644     | 644     | 680    | 700    |
| 866        | 490    | 584     | 580     | 667     | -----  | 690     | 708     | 750     | 777    | 755    |
| 869        | 450    | 542     | 550     | 611     | 618    | 652     | 670     | 692     | 711    | 710    |
| 871        | 503    | 596     | 607     | 671     | 680    | 724     | 742     | 750     | 800    | 800    |
| 876        | 503    | 605     | 619     | 672     | 658    | 728     | 744     | 760     | 800    | 809    |
| Average    | 487    | 582     | 598     | 657     | -----  | 704     | 722     | 736     | 776    | 781    |

| Animal No. | Aug. 8, 11 a. m. | Aug. 8, 1 p. m. | Aug. 14 | Aug. 22 | Aug. 29 | Sept. 4 | Sept. 10 | Sept. 18 | Sept. 26 |
|------------|------------------|-----------------|---------|---------|---------|---------|----------|----------|----------|
|            | Lbs.             | Lbs.            | Lbs.    | Lbs.    | Lbs.    | Lbs.    | Lbs.     | Lbs.     | Lbs.     |
| 858        | 843              | 888             | 952     | 950     | 948     | 994     | 984      | 880      | 1,024    |
| 860        | 756              | 766             | 836     | 860     | 898     | 895     | 888      | 920      | 963      |
| 862        | 680              | 698             | 755     | 750     | 764     | 778     | 790      | 814      | 805      |
| 864        | 626              | 628             | 716     | 708     | 728     | 740     | 746      | 786      | 786      |
| 866        | 691              | 689             | 804     | 794     | 816     | 828     | 828      | 866      | 864      |
| 869        | 656              | 698             | 756     | 755     | 782     | 788     | 788      | 818      | 832      |
| 871        | 752              | 766             | 820     | 828     | 822     | 853     | 848      | 884      | 900      |
| 876        | 764              | 752             | 840     | 825     | 830     | 854     | 864      | 896      | 908      |
| Average    | 721              | 736             | 810     | 809     | 823.5   | 841     | 842      | 858      | 885      |

<sup>1</sup> The cattle were brought to the station June 7.TABLE 6.—Weights of 13 cattle kept in pasture at Salina experiment station during summer of 1921<sup>1</sup>

| Animal No. | June 9 | June 11 | June 18 | June 25 | June 30 | July 9 | July 16 | July 23 | July 30 |
|------------|--------|---------|---------|---------|---------|--------|---------|---------|---------|
|            | Lbs.   | Lbs.    | Lbs.    | Lbs.    | Lbs.    | Lbs.   | Lbs.    | Lbs.    | Lbs.    |
| 861        | 591    | 622     | 643     | 680     | 699     | 722    | 768     | 808     | 816     |
| 867        | 479    | 522     | 524     | 561     | 671     | 619    | 660     | 685     | 694     |
| 870        | 584    | 623     | 605     | 650     | 673     | 714    | 766     | 790     | 798     |
| 872        | 548    | 572     | 595     | 624     | 631     | 661    | 692     | 724     | 724     |
| 899        | 548    | 565     | 524     | 570     | 590     | 628    | 668     | 676     | 698     |
| 904        | 502    | 536     | 542     | 580     | 571     | 617    | 658     | 666     | 686     |
| 907        | 714    | 750     | 748     | 797     | 821     | 840    | 883     | 896     | 920     |
| 908        | 457    | 514     | 510     | 524     | 548     | 588    | 600     | 616     | 632     |
| 912        | 676    | 722     | 725     | 755     | 770     | 824    | 844     | 856     | 882     |
| 913        | 470    | 493     | 490     | 520     | 544     | 558    | 605     | 614     | 650     |
| 914        | 542    | 583     | 591     | 604     | 638     | 670    | 700     | 730     | 751     |
| 918        | 578    | 616     | 610     | 639     | 666     | 693    | 750     | 750     | 780     |
| 919        | 876    | 921     | 923     | 959     | 986     | 1,000  | 1,046   | 1,054   | 1,052   |
| Average    | 581    | 618     | 618     | 651     | 677     | 703    | 741     | 759     | 776     |

| Animal No. | Aug. 6 | Aug. 13 | Aug. 20 | Aug. 27 | Sept. 3 | Sept. 10 | Sept. 17 | Sept. 24 |
|------------|--------|---------|---------|---------|---------|----------|----------|----------|
|            | Lbs.   | Lbs.    | Lbs.    | Lbs.    | Lbs.    | Lbs.     | Lbs.     | Lbs.     |
| 861        | 809    | 846     | 878     | 881     | 886     | 909      | 901      | 932      |
| 867        | 682    | 739     | 750     | 756     | 756     | 780      | 782      | 800      |
| 870        | 808    | 858     | 868     | 899     | 870     | 916      | 910      | 927      |
| 872        | 728    | 788     | 815     | 802     | 775     | 852      | 835      | 858      |
| 899        | 690    | 731     | 764     | 779     | 762     | 795      | 812      | 808      |
| 904        | 679    | 734     | 752     | 741     | 734     | 799      | 823      | 825      |
| 907        | 947    | 956     | 994     | 960     | 964     | 973      | 1,008    | 1,000    |
| 908        | 621    | 664     | 684     | 677     | 679     | 705      | 699      | 718      |
| 912        | 870    | 916     | 938     | 969     | 928     | 965      | 955      | 928      |
| 913        | 633    | 676     | 696     | 691     | 693     | 727      | 729      | 734      |
| 914        | 737    | 767     | 791     | 804     | 796     | 833      | 822      | 824      |
| 918        | 765    | 825     | 832     | 821     | 844     | 860      | 896      | 900      |
| 919        | 1,055  | 1,092   | 1,124   | 1,106   | 1,107   | 1,141    | 1,156    | 1,156    |
| Average    | 771    | 815     | 837     | 837     | 830     | 866      | 872      | 878      |

<sup>1</sup> The cattle were brought to the station June 7. None of these animals were used for experimental work during the summer of 1921, but some had been used in 1920.

TABLE 7.—Weights of 20 cattle kept in pasture at Salina experiment station during summer of 1922<sup>1</sup>

| Animal No. | June 6 | June 10 | June 17 | June 24 | July 1 | July 8 | July 15 | July 22 | July 29 |
|------------|--------|---------|---------|---------|--------|--------|---------|---------|---------|
|            | Lbs.   | Lbs.    | Lbs.    | Lbs.    | Lbs.   | Lbs.   | Lbs.    | Lbs.    | Lbs.    |
| 927        | 540    | 586     | 604     | 620     | 644    | 665    | 680     | 682     | 680     |
| 931        | 510    | 560     | 598     | 608     | 620    | 642    | 672     | 664     | 667     |
| 933        | 560    | 610     | 640     | 656     | 683    | 712    | 715     | 730     | 758     |
| 934        | 542    | 585     | 602     | 639     | 639    | 665    | 678     | 701     | 704     |
| 941        | 614    | 676     | 702     | 742     | 762    | 788    | 810     | 799     | 825     |
| 942        | 594    | 636     | 667     | 700     | 721    | 726    | 746     | 764     | 780     |
| 943        | 706    | 756     | 798     | 817     | 838    | 883    | 882     | 904     | 936     |
| 944        | 642    | 693     | 718     | 725     | 788    | 800    | 818     | 833     | 842     |
| 947        | 608    | 668     | 714     | 743     | 746    | 797    | 800     | 813     | 834     |
| 948        | 604    | 658     | 682     | 706     | 712    | 732    | 740     | 750     | 770     |
| 949        | 540    | 624     | 660     | 686     | 690    | 729    | 733     | 761     | 762     |
| 950        | 592    | 624     | 665     | 690     | 704    | 716    | 732     | 756     | 762     |
| 952        | 500    | 552     | 578     | 618     | 624    | 649    | 680     | 692     | 698     |
| 953        | 636    | 686     | 730     | 772     | 770    | 806    | 806     | 844     | 853     |
| 955        | 622    | 678     | 714     | 740     | 762    | 806    | 822     | 838     | 840     |
| 956        | 578    | 620     | 652     | 677     | 676    | 722    | 726     | 744     | 758     |
| 957        | 560    | 598     | 652     | 663     | 678    | 728    | 734     | 750     | 762     |
| 958        | 564    | 638     | 658     | 706     | 736    | 740    | 770     | 766     | 779     |
| 959        | 544    | 606     | 648     | 685     | 679    | 713    | 758     | 767     | 773     |
| 960        | 580    | 619     | 650     | 664     | 687    | 728    | 732     | 736     | 766     |
| Average    | 581    | 634     | 666     | 693     | 708    | 737    | 752     | 765     | 777     |

| Animal No. | Aug. 5 | Aug. 12 | Aug. 19 | Aug. 26 | Sept. 1 | Sept. 9 | Sept. 16 | Sept. 23 |
|------------|--------|---------|---------|---------|---------|---------|----------|----------|
|            | Lbs.   | Lbs.    | Lbs.    | Lbs.    | Lbs.    | Lbs.    | Lbs.     | Lbs.     |
| 927        | 710    | 705     | 740     | 751     | 774     | 796     | 797      | 787      |
| 931        | 722    | 710     | 724     | 742     | 768     | 764     | 798      | 770      |
| 933        | 766    | 792     | 817     | 805     | 849     | 844     | 858      | 870      |
| 934        | 732    | 732     | 799     | 775     | 804     | 810     | 838      | 824      |
| 941        | 844    | 854     | 888     | 924     | 903     | 908     | 914      | 918      |
| 942        | 824    | 808     | 846     | 830     | 859     | 880     | 892      | 883      |
| 943        | 960    | 962     | 1,003   | 1,051   | 1,019   | 1,060   | 1,058    | 1,085    |
| 944        | 880    | 868     | 900     | 906     | 918     | 904     | 945      | 938      |
| 947        | 834    | 850     | 877     | 870     | 890     | 824     | 917      | 900      |
| 948        | 778    | 785     | 817     | 816     | 832     | 832     | 864      | 834      |
| 949        | 828    | 804     | 818     | 845     | 856     | 878     | 872      | 859      |
| 950        | 782    | 785     | 814     | 816     | 840     | 864     | 850      | 870      |
| 952        | 733    | 748     | 760     | 767     | 780     | 794     | 800      | 797      |
| 953        | 918    | 882     | 924     | 960     | 950     | 954     | 978      | 960      |
| 955        | 852    | 875     | 906     | 918     | 929     | 930     | 956      | 930      |
| 956        | 762    | 789     | 814     | 822     | 843     | 821     | 844      | 834      |
| 957        | 820    | 804     | 842     | 864     | 847     | 844     | 878      | 871      |
| 958        | 816    | 830     | 836     | 836     | 878     | 888     | 874      | 883      |
| 959        | 796    | 820     | 838     | 840     | 849     | 860     | 895      | 886      |
| 960        | 812    | 780     | 822     | 862     | 855     | 880     | 868      | 852      |
| Average    | 808    | 809     | 839     | 850     | 862     | 867     | 885      | 878      |

<sup>1</sup> The cattle were brought to the station June 6.TABLE 8.—Weights of 22 cattle kept in pasture at Salina experiment station during summer of 1923<sup>1</sup>

| Animal No. | June 5 | June 9 | June 16 | June 23 | June 30 | July 7 | July 14 | July 21 | July 28 |
|------------|--------|--------|---------|---------|---------|--------|---------|---------|---------|
|            | Lbs.   | Lbs.   | Lbs.    | Lbs.    | Lbs.    | Lbs.   | Lbs.    | Lbs.    | Lbs.    |
| 937        | 614    | 662    | 703     | 696     | 722     | 746    | 756     | 804     | 798     |
| 940        | 532    | 572    | 631     | 644     | 660     | 693    | 724     | 734     | 760     |
| 946        | 632    | 698    | 759     | 720     | 765     | 786    | 850     | 845     | 857     |
| 963        | 620    | 646    | 688     | 697     | 722     | 772    | 760     | 786     | 782     |
| 966        | 540    | 610    | 645     | 666     | 686     | 722    | 768     | 762     | 762     |
| 967        | 580    | 617    | 659     | 662     | 700     | 714    | 734     | 740     | 760     |
| 972        | 544    | 648    | 695     | 685     | 716     | 763    | 790     | 795     | 790     |
| 973        | 500    | 552    | 593     | 593     | 624     | 646    | 644     | 696     | 683     |
| 975        | 464    | 530    | 550     | 564     | 593     | 622    | 624     | 662     | 684     |
| 976        | 442    | 500    | 533     | 533     | 570     | 590    | 615     | 638     | 640     |
| 977        | 612    | 663    | 705     | 720     | 742     | 750    | 760     | 784     | 798     |
| 978        | 576    | 650    | 685     | 695     | 700     | 708    | 740     | 754     | 772     |
| 979        | 510    | 600    | 625     | 652     | 674     | 704    | 720     | 745     | 732     |
| 980        | 450    | 538    | 568     | 582     | 616     | 630    | 646     | 684     | 704     |
| 981        | 432    | 500    | 520     | 531     | 557     | 596    | 590     | 606     | 620     |
| 985        | 446    | 508    | 553     | 557     | 590     | 583    | 620     | 612     | 618     |
| 986        | 528    | 606    | 645     | 662     | 688     | 710    | 750     | 760     | 772     |
| 988        | 700    | 788    | 856     | 834     | 875     | 906    | 922     | 978     | 928     |
| 989        | 623    | 678    | 707     | 712     | 744     | 776    | 772     | 764     | 792     |
| 991        | 465    | 503    | 541     | 549     | 562     | 596    | 600     | 624     | 620     |
| 992        | 484    | 576    | 589     | 612     | 644     | 680    | 697     | 720     | 730     |
| 993        | 616    | 700    | 740     | 746     | 774     | 814    | 815     | 898     | 865     |
| Average    | 541    | 607    | 645     | 651     | 678     | 705    | 723     | 745     | 748.5   |

<sup>1</sup> The cattle were brought to the station June 5.

TABLE 8.—Weights of 22 cattle kept in pasture at Salina experiment station during summer of 1923—Continued

| Animal No.   | Aug. 4 | Aug. 11 | Aug. 18 | Aug. 25 | Sept. 1 | Sept. 8 | Sept. 15 | Sept. 22 |
|--------------|--------|---------|---------|---------|---------|---------|----------|----------|
|              | Lbs.   | Lbs.    | Lbs.    | Lbs.    | Lbs.    | Lbs.    | Lbs.     | Lbs.     |
| 937.....     | 818    | 826     | 832     | 850     | 870     | 887     | 872      | 884      |
| 940.....     | 780    | 774     | 810     | 840     | 840     | 854     | 853      | 854      |
| 946.....     | 868    | 896     | 906     | 918     | 925     | 938     | 943      | 972      |
| 963.....     | 848    | 840     | 857     | 894     | 918     | 894     | 940      | 900      |
| 966.....     | 794    | 782     | 824     | 846     | 852     | 868     | 879      | 880      |
| 967.....     | 778    | 813     | 825     | 800     | 845     | 844     | 850      | 861      |
| 972.....     | 842    | 825     | 868     | 884     | 906     | 918     | 935      | 930      |
| 973.....     | 722    | 710     | 726     | 766     | 780     | 796     | 817      | 796      |
| 975.....     | 690    | 738     | 713     | 738     | 774     | 772     | 771      | 780      |
| 976.....     | 658    | 661     | 681     | 700     | 725     | 732     | 747      | 758      |
| 977.....     | 826    | 815     | 850     | 882     | 888     | 892     | 877      | 898      |
| 978.....     | 790    | 786     | 856     | 830     | 858     | 876     | 905      | 886      |
| 979.....     | 779    | 772     | 808     | 810     | 834     | 823     | 826      | 852      |
| 980.....     | 726    | 720     | 752     | 760     | 780     | 786     | 808      | 792      |
| 981.....     | 664    | 648     | 690     | 700     | 730     | 727     | 712      | 744      |
| 985.....     | 672    | 635     | 679     | 686     | 708     | 699     | 704      | 681      |
| 986.....     | 804    | 782     | 820     | 848     | 874     | 889     | 893      | 911      |
| 988.....     | 1,000  | 942     | 986     | 984     | 1,048   | 1,040   | 1,026    | 1,052    |
| 989.....     | 817    | 800     | 832     | 852     | 868     | 860     | 854      | 877      |
| 991.....     | 658    | 648     | 670     | 690     | 702     | 700     | 700      | 726      |
| 992.....     | 750    | 756     | 782     | 790     | 804     | 812     | 819      | 822      |
| 993.....     | 900    | 894     | 918     | 946     | 970     | 990     | 983      | 1,000    |
| Average..... | 781    | 776     | 804     | 819     | 841     | 845     | 851      | 858      |

TABLE 9.—Weights of 16 cattle kept in pasture at Salina experiment station during summer of 1924<sup>1</sup>

| Animal No.   | June 8 | June 14 | June 21 | June 28 | July 5 | July 12 | July 19 | July 26 | Aug. 2 | Aug. 9 | Aug. 16 | Aug. 23 | Aug. 30 | Sept. 6 | Sept. 13 | Sept. 21 |
|--------------|--------|---------|---------|---------|--------|---------|---------|---------|--------|--------|---------|---------|---------|---------|----------|----------|
|              | Lbs.   | Lbs.    | Lbs.    | Lbs.    | Lbs.   | Lbs.    | Lbs.    | Lbs.    | Lbs.   | Lbs.   | Lbs.    | Lbs.    | Lbs.    | Lbs.    | Lbs.     | Lbs.     |
| 999.....     | 718    | 756     | 772     | 838     | 825    | 830     | 862     | 874     | 886    | 902    | 923     | 946     | 970     | 986     | 986      | 946      |
| 1000.....    | 710    | 740     | 790     | 842     | 838    | 866     | 872     | 914     | 924    | 962    | 994     | 980     | 982     | 1,024   | 1,012    | 1,045    |
| 1001.....    | 600    | 654     | 678     | 704     | 716    | 714     | 736     | 770     | 784    | 805    | 830     | 830     | 862     | 868     | 879      | 836      |
| 1002.....    | 650    | 670     | 706     | 760     | 730    | 770     | 766     | 800     | 814    | 842    | 883     | 856     | 874     | 916     | 905      | 916      |
| 1004.....    | 500    | 554     | 584     | 606     | 576    | 626     | 620     | 665     | 662    | 713    | 724     | 732     | 734     | 794     | 771      | 768      |
| 1009.....    | 604    | 658     | 670     | 690     | 694    | 730     | 704     | 740     | 730    | 744    | 779     | 808     | 782     | 820     | 834      | 818      |
| 1012.....    | 622    | 686     | 708     | 742     | 752    | 761     | 766     | 804     | 806    | 842    | 852     | 866     | 862     | 912     | 864      | 869      |
| 1013.....    | 610    | 644     | 674     | 694     | 710    | 714     | 738     | 760     | 761    | 800    | 806     | 809     | 816     | 856     | 838      | 852      |
| 1015.....    | 610    | 644     | 700     | 748     | 728    | 764     | 747     | 767     | 765    | 794    | 837     | 818     | 842     | 854     | 828      | 868      |
| 1018.....    | 580    | 640     | 670     | 693     | 690    | 697     | 725     | 758     | 736    | 802    | 810     | 833     | 818     | 890     | 838      | 870      |
| 1019.....    | 500    | 510     | 552     | 578     | 580    | 624     | 605     | 642     | 650    | 674    | 694     | 696     | 798     | 742     | 728      | 733      |
| 1020.....    | 630    | 698     | 710     | 754     | 742    | 780     | 763     | 812     | 794    | 844    | 880     | 874     | 876     | 910     | 868      | 876      |
| 1021.....    | 490    | 540     | 544     | 563     | 584    | 618     | 616     | 645     | 696    | 708    | 731     | 724     | 742     | 758     | 762      | 770      |
| 1030.....    | 470    | 540     | 562     | 598     | 605    | 641     | 616     | 648     | 670    | 712    | 720     | 723     | 705     | 776     | 733      | 758      |
| 1033.....    | 585    | 658     | 650     | 700     | 696    | 713     | 720     | 742     | 736    | 778    | 806     | 812     | 805     | 850     | 851      | 835      |
| 1034.....    | 600    | 650     | 686     | 712     | 716    | 729     | 740     | 760     | 772    | 800    | 806     | 826     | 828     | 865     | 842      | 867      |
| Average..... | 592    | 640     | 666     | 701     | 699    | 724     | 725     | 756     | 762    | 795    | 817     | 821     | 831     | 864     | 846      | 852      |

<sup>1</sup> The cattle were brought to the station June 8.

## AVERAGE YEARLY GAINS

The gains during the entire season are shown better in Table 10, in which the averages for the different years are given. This table shows the initial and final weights for each year, together with the dates of these weighings and the gains made, both in pounds and per cent of the initial weight. It also shows the number of days between the initial and final weighings and the average daily gains.

In comparing Table 10 with Tables 1 to 9, it will be noticed that the first weights, except in 1916, 1918, and 1919, are not taken as the initial weights in computing the season's gains. This is because in the other years the first weights were made after the cattle had

been driven nearly 20 miles and in some instances had been corralled overnight. In such cases the weighings after the cattle had been on good feed for a few days were used as the initial weights.

TABLE 10.—*Summary showing gains annually made by cattle in pasture at Salina experiment station, 1916 to 1924, inclusive*<sup>1</sup>

| Year      | Animals weighed | Initial weights |         | Final weights |         | Average increase in weight |          | Time observed | Average daily gain |
|-----------|-----------------|-----------------|---------|---------------|---------|----------------------------|----------|---------------|--------------------|
|           |                 | Date            | Average | Date          | Average |                            |          |               |                    |
|           | Number          |                 | Pounds  |               | Pounds  | Pounds                     | Per cent | Days          | Pounds             |
| 1916----- | 9               | June 7          | 616     | Sept. 23      | 887     | 271                        | 44       | 108           | 2.51               |
| 1917----- | 11              | June 19         | 618     | Sept. 28      | 873     | 255                        | 41.3     | 101           | 2.52               |
| 1918----- | 6               | May 30          | 626     | Sept. 29      | 920.5   | 294.5                      | 47       | 122           | 2.41               |
| 1919----- | 3               | June 23         | 781     | Sept. 26      | 1,064   | 283                        | 36.2     | 95            | 2.98               |
| 1920----- | 8               | June 10         | 582     | do-----       | 885     | 303                        | 52.1     | 108           | 2.81               |
| 1921----- | 13              | June 11         | 618     | Sept. 24      | 878     | 260                        | 42.1     | 105           | 2.48               |
| 1922----- | 20              | June 10         | 634     | Sept. 23      | 878     | 244                        | 38.5     | 105           | 2.32               |
| 1923----- | 22              | June 9          | 607     | Sept. 22      | 858     | 251                        | 41.3     | 105           | 2.39               |
| 1924----- | 16              | June 14         | 640     | Sept. 21      | 852     | 212                        | 33.1     | 99            | 2.14               |

<sup>1</sup> These cattle were not used in experimental feedings.

The average gain for the different seasons is seen to be fairly uniform, varying between 33.1 per cent in 1924 and 52.1 per cent in 1920, and having an average of 41.05 per cent for all animals.

The low average gain in 1924 was made during a very dry season; that of 1919 was for only three animals, all of which were 3 or more years old and were in the pasture only 95 days. The high average of the 1920 group was for five yearlings and three 2-year-olds which had been under observation 108 days.

The average gains, estimated as pounds per animal, in the different years varied between 212 pounds in 1924 and 303 pounds in 1920, with a general average of 255.1 pounds for all animals.

The average daily gains range from 2.14 pounds per animal for 16 animals during 99 days in 1924 to 2.98 pounds per animal for three animals during 95 days in 1919. The average daily gain per head for all animals in all years was 2.43 pounds.

Figure 4 shows the average ratio of gain of all the cattle used in the nine years. In this illustration the length of time the animals had been under observation, rather than dates, was used as the basis for determining gains. This was advisable because the weighings did not start on the same date each year. The date on which the cattle were put into the pasture was more dependent on the advancement of the season than on any other one factor. In working out these gains the week was used as the unit of time and the gains were figured as percentages of initial weights.

In the nine years the weights of 108 cattle were obtained. These weighings continued in all the years for at least 13 weeks. The 1919 group consisting of three animals was not continued for 14 weeks, and so only 105 animals are included in this average. Similarly the 11 animals of the 1917 group and the 16 animals of the 1924 group are not included in the fifteenth week. Stated in another way, for the first 13 weeks the weights of 108 animals are used in computing the percentage gained; in the fourteenth week the weights of 105 animals and in the fifteenth week those of 78 animals were used. The six animals of the 1918 group were continued for 17

weeks, but they were too few in number and were not weighed frequently enough to form the basis for drawing conclusions.

Figure 4 shows that the average gains were rapid early in the season and gradually diminished in rate as the season advanced, but continued on the average until the last weighing in the fall; as a rule about the last week in September. On the basis of this curve one would expect the gains to cease about the middle or last of October.

The curves for the different years as shown in Figures 1 to 3 bring out the same general facts with slight variations, depending probably on a variety of factors.

In Table 11 are shown the variations in the gains made in the different years, in both pounds and per cent. The results for the different years compare very favorably. The animals making the

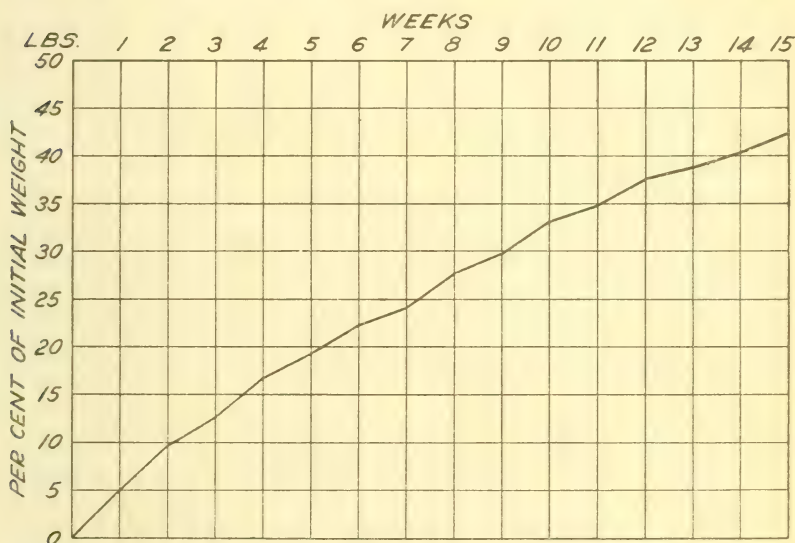


FIG. 4.—Average gains of all cattle used in the nine years, 1916 to 1924, inclusive. The gains are shown as percentages of initial weight

### VARIATIONS IN GAINS

smallest or largest gains in pounds are not necessarily those making the poorest or best gains when figured as percentages of the initial weight. An animal having a small initial weight may make a large percentage gain which does not mean so much in pounds as the smaller percentage gain made by a large animal. The smallest gain in pounds was 160 made by a yearling steer; the poorest showing, when figured as per cent of initial weight, was made by a 3-year-old steer. Both these animals were of the 1924 group.

The largest gain was 381 pounds made by a 2-year-old steer in 1920, an increase of 65.5 per cent over the original weight. One animal in the 1917 group made a gain of 336 pounds, which was 49.4 per cent of its original weight. Another weighed 342 pounds on June 19 and 584 pounds on September 28, making a gain of 70.8 per cent. The average gains for the different years varied between 212 pounds in 1924 and 303 pounds in 1920. Stated in terms of

percentage gains, the variation was from 33.1 per cent in 1924 to 52.1 per cent in 1920. As has been stated elsewhere, the summer of 1924 was very dry; the 1919 animals, which made an average gain of only 36.2 per cent, were under observation only 95 days as against 108 days for the 1920 group and 105 days as a general average for all the animals in the nine years. In addition all the 1919 animals were 3 or more years old and had an average initial weight of 781 pounds.

TABLE 11.—*Minimum, maximum, and average gains 1916 to 1924*

| Year      | Minimum gain |          | Maximum gain |          | Average gain |          |
|-----------|--------------|----------|--------------|----------|--------------|----------|
|           | Pounds       | Per cent | Pounds       | Per cent | Pounds       | Per cent |
| 1916..... | 196          | 29.1     | 334          | 64       | 271          | 44       |
| 1917..... | 196          | 26.5     | 336          | 70.8     | 255          | 41.3     |
| 1918..... | 273          | 39.2     | 312          | 58.1     | 294.5        | 47       |
| 1919..... | 260          | 32.9     | 328          | 41.4     | 283          | 36.2     |
| 1920..... | 241          | 42.7     | 381          | 65.5     | 303          | 52.1     |
| 1921..... | 204          | 25.5     | 310          | 53.9     | 260          | 42.1     |
| 1922..... | 176          | 26.7     | 329          | 46.2     | 244          | 38.5     |
| 1923..... | 173          | 29.3     | 305          | 51.6     | 251          | 41.3     |
| 1924..... | 160          | 24.3     | 305          | 43.7     | 212          | 33.1     |

The cattle are roughly classified as yearlings, 2 years old, and 3 or more years old. This classification is not exact, but it may serve as a basis for arriving at some idea of the influence of age on growth under the prevailing conditions. In Table 12 such a division has been made and the yearly averages for each group in the different years is shown. In this table the averages in pounds and per cent are shown, together with the number of animals in each class.

TABLE 12.—*Gains according to age*

| Year          | Yearlings |              |         | 2 years old |              |         | 3 or more years old |              |         |
|---------------|-----------|--------------|---------|-------------|--------------|---------|---------------------|--------------|---------|
|               | Animals   | Average gain |         | Animals     | Average gain |         | Animals             | Average gain |         |
|               |           | Pounds       | Per ct. |             | Pounds       | Per ct. |                     | Pounds       | Per ct. |
| 1916.....     | 5         | 248.0        | 43.0    | 3           | 307.0        | 48.3    | 1                   | 282          | 37.6    |
| 1917.....     | 2         | 229.0        | 61.8    | 9           | 261.0        | 38.8    | 1                   | 281          | 45.0    |
| 1918.....     |           |              |         | 5           | 297.2        | 47.4    | 3                   | 283          | 36.2    |
| 1919.....     | 5         | 294.0        | 52.8    | 3           | 320.0        | 51.3    |                     |              |         |
| 1920.....     | 2         | 222.5        | 44.1    | 10          | 269.1        | 44.1    | 1                   | 235          | 25.5    |
| 1921.....     | 9         | 242.7        | 39.9    | 11          | 254.0        | 39.3    |                     |              |         |
| 1922.....     | 5         | 244.0        | 46.5    | 16          | 252.0        | 40.6    | 1                   | 264          | 33.5    |
| 1923.....     |           |              |         | 12          | 211.25       | 34.8    | 4                   | 212          | 29.7    |
| 1924.....     |           |              |         |             |              |         |                     |              |         |
| Total.....    | 28        |              |         | 69          |              |         | 11                  |              |         |
| Averages..... |           | 250.6        | 45.8    |             | 258.0        | 40.9    |                     | 251          | 33.5    |

Considering all the animals in each class, the yearlings gained an average of 250.6 pounds, or 45.8 per cent; the 2-year-olds, 258 pounds, or 40.9 per cent; and the older group gained an average of 251 pounds, or 33.5 per cent. In other words, although the older animals gained about the same in pounds as the younger ones, the gain in per cent was considerably less. To put this in another way, two 500-pound animals made much more growth in a season than one 1,000-pound animal.

In the growth curves for the different years, shown in Figures 1, 2, and 3, there are several irregularities in which the rate of increase for a given week is greater or less than that expected from the general trend of the curve. This is well shown in the curve for 1923. The first portion of this curve, from June 5 to 9, shows the very rapid gain of 66 pounds in four days. The animals had been held in a corral the night of June 4 and driven 20 miles the next day before being weighed. In this case the weights of June 9 were taken as initial weights. During the week of July 21 to 28 an average gain of only 3.5 pounds was made, and between August 4 and 11 the cattle lost weight. In each case, however, the gains during the following week were greater than the average. Perhaps such inequalities in a curve are to be expected when so few animals are used. Several factors may influence the weights at a given time, such as weather conditions, the time of day they are weighed, whether they have been near the watering places or on the ridges just before being weighed, and the length of time they have stood in the corral before being weighed. The last two factors are probably the most important.

It was customary to collect all the cattle in the corral before starting weighing. When they were scattered over the pasture, it meant that some animals stood in the corral three or four hours before the others were found, which allowed a considerable shrinkage in weight. The loss in weight or shrinkage is brought out in the table of weights for 1920. On August 7 of that year eight head were brought in and found to have an average weight of 781 pounds. They were left in the corral without feed or water until 11 a. m. August 8, when the weight had fallen to 721 pounds, or a loss of about 60 pounds per animal. They were then allowed to run about two hours in a corral where there was water, when the average weight was found to be 15 pounds more, or 736 pounds. This average gain was made in spite of the fact that apparently two of the animals did not drink. The shrinkage overnight varied between 39 and 91 pounds, the largest loss being 9.7 per cent of the weight of the animal when it was brought in from the pasture. The average shrinkage of all the cases was 7.6 per cent.

During the two hours in the watering corral the changes in weights varied between a loss of 12 pounds and a gain of 45 pounds. Although it is not probable that these are the only causes of the irregularities in the curves, they may well be important factors and at least serve to illustrate the importance of the greatest possible uniformity in the conditions under which weighings are made for comparative purposes.

#### SUMMARY

Data obtained at the Salina experiment station on the normal gains made by cattle during the summer months under range conditions show, in brief, that:

The average gain of 108 animals for the season was found to be 255.1 pounds, or 41.05 per cent, and the average daily increase was 2.43 pounds.

The rate of gain was most rapid in the early part of the season and gradually slowed down in the fall.

Young animals made larger gains than the older ones, when figured as a percentage of the initial weight, though the gains were about the same in pounds.

# ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

January 8, 1926

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12

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